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REGIONAL GEOLOGY AND
METHODOLOGY OF GROUND-WATER ACCESS
LEE'S LANE LANDFILL
JEFFERSON COUNTY, KENTUCKY

TDD NO. F4-8212-126

April 16, '84

PROJECT FOR PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES AT UNCONTROLLED HAZARDOUS SUBSTANCE FACILITIES—ZONE 1

NUS CORPORATION
SUPERFUND DIVISION

R-586-4-4-8

REGIONAL GEOLOGY AND METHODOLOGY OF GROUND-WATER ACCESS LEE'S LANE LANDFILL JEFFERSON COUNTY, KENTUCKY

TDD NO. F4-8212-126
CONTRACT NO. 68-01-6699

FOR THE

AIR AND WASTE MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

APRIL 16, 1984

NUS CORPORATION
SUPERFUND DIVISION

SUBMITTED BY	TECHNICAL REVIEW BY	APPROVED BY
James T. Duffey	Donna Wallace	Murray Warner, P.E.
Project Manager	Assistant Regional Project Manager	Regional Project Manager

NOTICE

The information in this document has been funded wholly by the United States Environmental Protection Agency (EPA) under Contract Number 68-01-6699 and is considered proprietary to the EPA.

TABLE OF CONTENTS

FIGURES

EXECUTIVE SUMMARY

Under Environmental Protection Agency (EPA) Technical Direction Document (TDD) No. F4-8212-126, NUS Corporation (NUS) was tasked to subcontract and supervise the installation of 10 ground-water monitoring wells at Lee's Lane Landfill, Jefferson County, Kentucky.

Lee's Lane Landfill is located on the east bank of the Ohio River, south of Louisville, Kentucky. The site covers approximately 125 acres of relatively flat land that supports grasses and shrubs. During its period of operation from 1952 to 1975, the landfill accepted domestic, commercial and industrial waste. The site was previously a sand and gravel quarry. Action on the site was prompted by the migration of methane gas into a nearby residential area. During February 1980, drums containing hazardous materials were discovered on the site. Most surface drums have since been removed. Ground-water wells were installed by the Kentucky Natural Resources, Environmental Protection Division. However, the wells were considered unsuitable to obtain representative ground-water samples. A geophysical survey by the Region IV FIT delineated suspected buried drum areas and soil/ground-water contamination. The report recommended monitoring wells be installed.

The originally proposed well installation method for this project had to be modified when high concentrations of organic vapors and explosive gases were encountered. Using an ammended methodology of well installation, FIT and its subcontractors augered and sampled three holes in the landfill, which were then backfilled with bentonite pellets. The sample analyses are to be addressed under a separate report.

The findings of this project suggest that, if ground-water wells are necessary at the site, they should be installed off site because of the explosive gases in the landfill and the potential for spreading contamination by drilling directly through the landfill.

1.0 INTRODUCTION

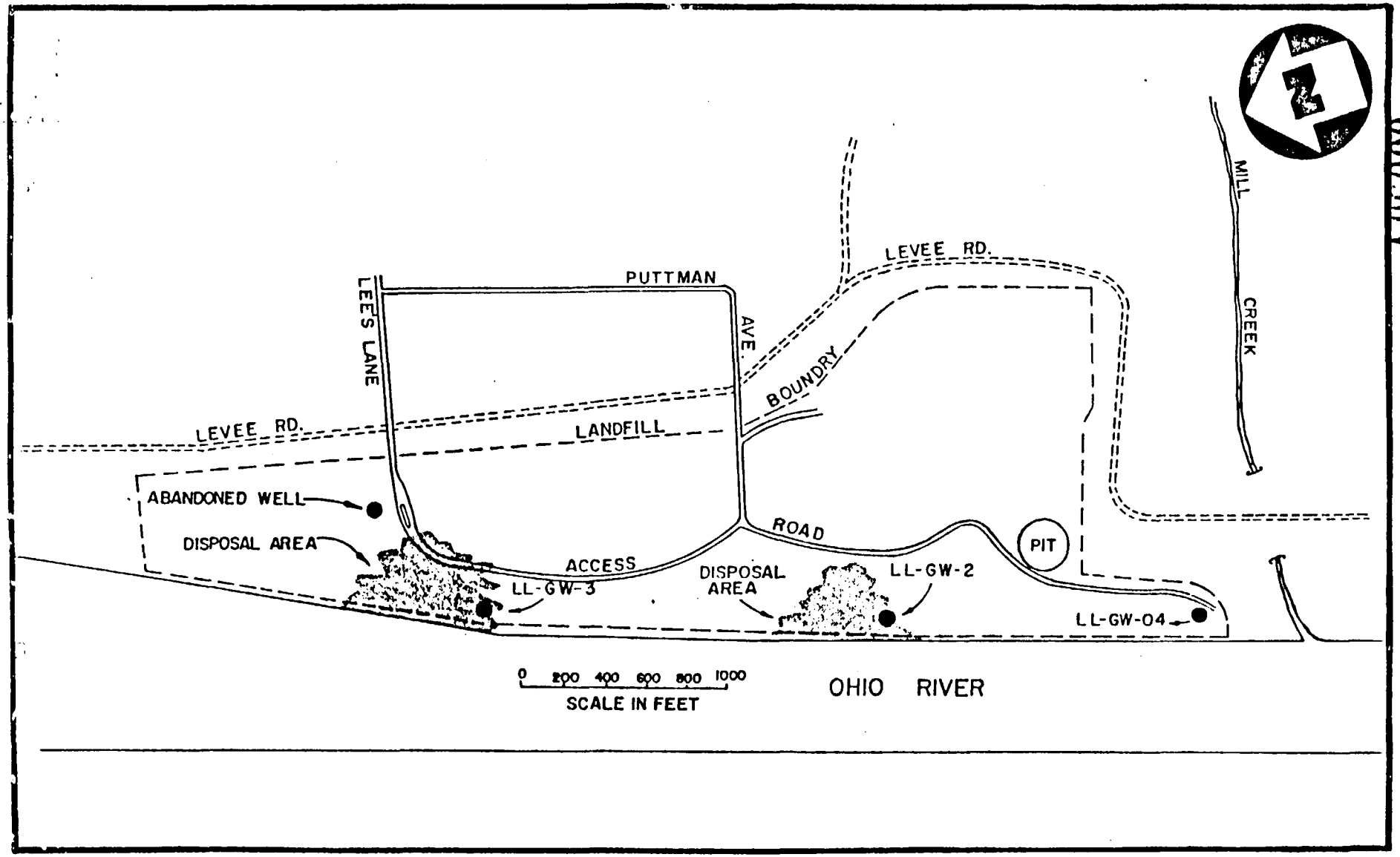
Under Environmental Protection Agency (EPA) Technical Direction Document (TDD) No. F4-8212-126, NUS Corporation (NUS), Field Investigation Team (FIT), was tasked to subcontract and supervise the installation of 10 ground-water monitoring wells at the Lees's Lane Landfill Site, Jefferson County, Kentucky. Fuller, Mossbarger, Scott and May, Civil Engineers, Lexington, Kentucky (FMSM) was subcontracted for well installation. The first attempt at well installation occurred during the period April 28 to May 6, 1983.

The project was delayed due to flooding of the Ohio River and the release of explosive gases while drilling. FIT was prepared to work in Level C protection. However, airborne contaminants in excess of those anticipated were released from the subsurface by the drilling. This further justified the delay of the project because level B respiratory equipment and sufficient personnel to support a level B operation were not immediately available. After a re-evaluation of the procedure of well installation, FIT and FMSM remobilized to the site for a second attempt to install the water wells. Ground water from the landfill was to be sampled during the drilling. The wells were then to be extended into the aquifer below the landfill and completed as permanent monitoring wells. The second installation attempt was conducted from July 5 to July 15, 1983.

1.1 Site Location/Description

Lee's Lane Landfill is located on the east bank of the Ohio River, latitude 38° 11' 31" N., longitude 85° 52' 56" E., south of Louisville, Kentucky (Fig. 1.1). The site is bordered to the east and south by floodwalls.

The 125-acre landfill surface is relatively flat with the exception of an excavated pit on the southeast corner of the site and an elongate depression between the levee road and landfill boundary on the east side of the site (fig. 1.2). Grasses and shrubs cover the site and trees are present on the bank of the Ohio River. A paved access road that traverses the site allows entrance to the site via Lee's Lane (fig. 1.2).



LL-GW-01 LOCATED IN RIVERSIDE GARDENS PARK

WELL LOCATION MAP
LEE'S LANE LANDFILL
JEFFERSON CO., KY.

FIGURE 1.2

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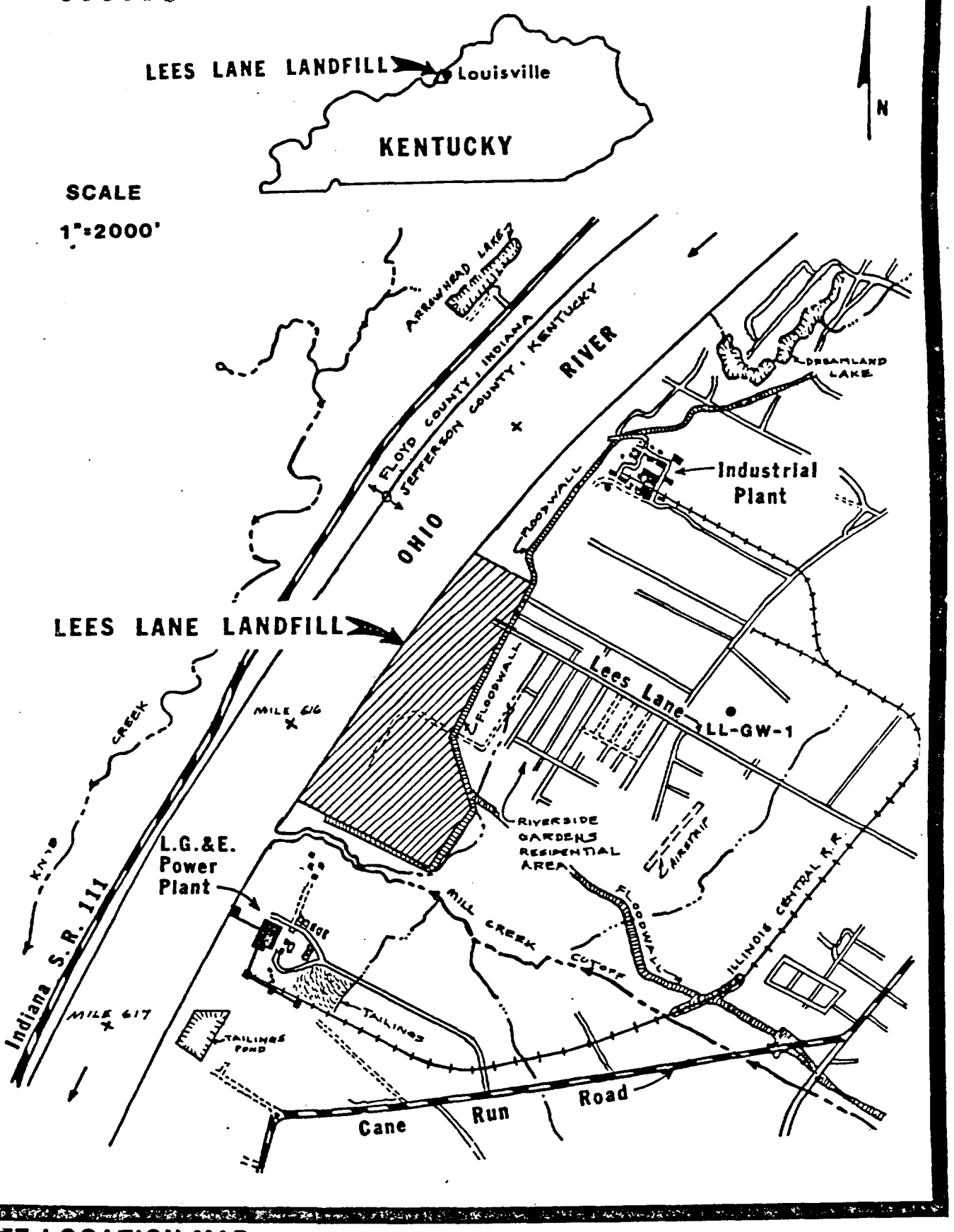

SITE LOCATION MAP
LEE'S LANE LANDFILL
JEFFERSON COUNTY, KENTUCKY FIGURE 1.1

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1.2 Site History

The following information was taken from the Emergency Action Plan, 1981:

> Lee's Lane Landfill first received wastes in 1952 from domestic, commercial, and industrial sources. Prior to its receiving wastes, the site was a sand and gravel quarry operated by the Hofgesang Company. In March 1975, home owners in Riverside Gardens, a community adjacent to the site, reported flash fires around their water heaters. Subsequent to an investigation and the detection of explosive levels of methane gas, seven families were evacuated from their homes near the site. In April 1975 the landfill was closed. Studies conducted by county, state, and federal agencies documented the presence of methane and other toxic-gas compounds in the subsurface east of the site. In 1978 an extensive monitoring program was conducted by Stearns, Conrad, and Schmidt Consulting Engineers to define the gas migration problem. A gas-venting system was finally installed in October 1980 which, according to the Jefferson County Works Department, is operating satisfactorily.
>
> A more recent problem associated with this site is the discovery in February 1980 of approximately 400 exposed drums of hazardous materials on the Ohio River bank adjacent to the landfill. The drums are located approximately 100 feet from the river and well within the flood stage area. Over 50 compounds were identified by chemical analysis. They included phenolic resins, benzene, and relatively high concentrations of copper, cadmium, nickel, lead and chromium. Flash points were determined to be as low as 75°F. Following this discovery and analysis, the State of Kentucky informed the executor of the now Hofgesang Foundation of the hazardous situation.
>
> Ground-water monitoring wells were installed by the Kentucky Department of Natural Resources and Environmental Protection through a grant from the Water Resources Council of the Department of Interior. These wells were completed by March 1981.

Due to the methodology and materials used in the well construction, samples obtained from the wells contained a large quantity of sediment and the wells were not suitable for obtaining representative ground-water samples (H.W.S.I., April, 1981). Most drums stored on the site were removed during September, 1981.

During March through May, 1982, FIT conducted a geophysical survey to locate possible drum burial locations and ground-water contamination at the site. The findings of the survey delineated several areas of suspected drum burial and subsurface contamination. The report recommended the installation of 10 ground-water monitoring wells on the site.

2.0 METHODOLOGY

The initial proposal to install 10 ground-water wells on Lee's Lane Landfill specified that the wells were to be drilled by the mud-rotary method. The wells were to penetrate the landfill and allow access to the alluvial aquifer that lies below the landfill. The final wells were to be constructed with stainless steel, four-inch diameter well screens and four-inch diameter black-steel casing. Drill operations were conducted at the site during April and May, 1983 and again during July, 1983.

The initial attempt to install the wells was abandoned because of flooding of the Ohio River and high concentrations of explosive gases released from the boreholes as indicated by air-monitoring equipment. The two drill rigs were forced to evacuate location LL-GW-3 and a location approximately 700 feet east of LL-GW-3 due to flooding (Fig. 1.2). At the time of demobilization from the first two wells, the river level was approximately six inches below the drill rig and the river was predicted to crest 24 hours later and five feet higher. For this reason these two wells were abandoned with the intention to complete the well drilling after the flood waters receded. Because air-monitoring equipment indicated the presence of organic vapors at these locations, the holes were sealed with bentonite clay pellets and abandoned. At this point, seven of the proposed ten well locations were inaccessible due to the flood waters. A third location was abandoned due to high concentrations of explosive gases released from the borehole as indicated by air-monitoring equipment ("abandoned well", Fig. 1.2). FIT concluded that the concentration of explosive gases released from the landfill during the flood would be higher than usual because the rising water table would displace pore space in the subsurface and force the gases to occupy a smaller volume. This decrease in volume caused the gases to be under greater pressure and consequently, their release during drilling was increased. Communications between the field crew, NUS Project Manager and EPA Deputy Project Officer, concerning the above events resulted in the decision to delay the project and prevent further costs incurred from the flooding.

From the date of abandonment to the date of remobilization, the well-installation methodology was amended. The drill crew and FIT were to be prepared to work under Level B respiratory protection when air-monitoring equipment indicated the concentration of organic vapors to be above that of the ambient air. A 12-inch diameter hole was to be augered to the water table in the landfill. A sample of this water was to be taken. The hole was then to be extended through the landfill and 10-inch diameter corrugated metal pipe was to be installed in the temporary hole. The metal pipe was to extend the entire thickness of the landfill in order to prevent the migration of landfill waters into the aquifer. By casing the landfill off, FIT anticipated that the wells could be completed in level D protection since the concentration of contaminants should be lower in the alluvium that underlies the landfill. The wells were to be completed as permanent ground-water wells with the corrugated pipe removed. Due to the presence of explosive gases, the EPA Deputy Project officer and the NUS Project Manager proposed the number of wells to be completed be reduced to four. This suggestion was based on the intentions to fulfill the original objectives of the project without exposing those involved to unnecessary risks due to the explosive gases. An upgradient well, LL-GW-1, was installed in Riverside Gardens Park (Fig. 1.1). LL-GW-2, LL-GW-3, and LL-GW-4 were installed on the landfill in locations considered to be down the hydraulic gradient of major waste-disposal areas as indicated by the 1982 geophysical survey (Fig. 1.2).

Wells LL-GW-2 and LL-GW-3 were augered and sampled in Level B protection because of high concentrations of organic vapors as indicated by air-monitoring equipment. A sample of the water from the landfill was taken from LL-GW-3 at a depth of 28 feet below the land surface. At location LL-GW-2, air-monitoring equipment indicated the presence of high concentrations of explosive gases. Though portable fans did disperse the gases above ground, the fans could not eliminate the possibility of ignition of explosive gases in the hole caused by drilling tools striking metallic objects in the landfill. The concentrations of explosive gases encountered at that time were on the order of 80% of the lower explosive limit. Because of the potential for an explosion, the hole was terminated at 17 feet below the land surface and a soil/sediment sample was collected from the same depth. At location LL-GW-4, air-monitoring equipment did not indicate the

presence of organic vapors or explosive gases. A water sample was collected from a depth of 38 feet.

With the approval of the EPA Deputy Project Officer, the installation of permanent wells in the aquifer was abandoned due to the safety risk imposed by the presence of explosive gases. After sampling, all borings were sealed with bentonite clay pellets and abandoned.

3.0 REGIONAL GEOLOGY/HYDROLOGY

The following information has been obtained from the Emergency Action Plan, 1981:

> Lee's Lane Landfill is underlain by the Ohio River Valley Alluvium of Quaternary age. It is approximately 130 feet thick and generally composed of 5 to 40 feet of clay, silt, and fine-grained sand overlying sand and gravel with clay lenses (Palmquist and Hall, 1960). The New Albany shale of Devonian age underlies the alluvium. It is approximately 100 feet thick and dips to the west with a gradient of 40 feet per mile (Mill Creek EIS, 1980).
>
> Ground-water availability in the area is good. The alluvium is capable of yielding 200 to 500 gallons per minute to most wells which penetrate the full saturated thickness of the aquifer. The New Albany Shale of Devonian age underlies the alluvium and wells intersecting fractures and joints within the shale are capable of yielding 100 to 500 gallons per day. The shale is of secondary importance due to the abundant ground-water resources of the alluvium and the difficulty of intersecting the fractures and joints (Bell, 1966). Just north of the site, the alluvium has reported a transmissivity of 2,680 square feet per day near the shoreline of the Ohio River. Landward from the shoreline the transmissivity is reported to be 6,030 square feet per day. The reported hydraulic conductivity is 134 feet per day (Price, 1964). Ground-water velocities are reported to vary between 2 feet per day and 36 feet per day (Grubb, 1970).
>
> There is good hydraulic connection between the alluvium and the Ohio River adjacent to the site. Induced infiltration of surface water into the ground water is therefore common and a responsive nature exists between fluctuations in the river level and the ground-water level (Bell, 1966). Ground-water levels are reported to fluctuate as much as 10 feet seasonally (Riverport EIR, 1980). In Water Year 1979 the U.S. Geological Survey observed water levels north of the site varying from 25.28 to 47.77 feet below land surface (U.S.G.S., 1980).

The exact direction of ground-water flow in the immediate area surrounding and underlying the site has not been defined, but based upon past studies both north and south of the site, the general direction of flow is normally toward the river. During flood stages the ground-water flow direction is reversed. One abnormality of this east-west flow is the presence of a cone of depression in the potentiometric surface north of the site. This depression is due to the large volume of pumpage from industrial wells north of the landfill (Bell, 1966). The pumpage from these wells has increased since 1977, but the present limit of the cone of depression has not been defined.

Ground-water quality in the area is generally good except where localized pollution sources exits. Relatively high nitrate concentrations in the ground water east and south of the site indicated wide-spread pollution from nitrate bearing waters derived from on-site septic tanks (Riverport EIR, 1980). Water in the alluvium and bedrock formations is characterized as a calcium bicarbonate type. The hardness of the water from bedrock sources is dependent upon the type of rock from which it is pumped (Bell, 1966).

The following geologic descriptions pertain to samples observed during the drilling and augering process:

LL-GW-01 (Figure 1.1)

Depth	Description
0'-20'	Brown silty clay
20'-30'	Fine-medium grained sand
30'-53'	Medium-coarse grained sand

LL-GW-02 (Figure 1.2)

Depth	Description
0'-17'	Fill material

LL-GW-03 (Figure 1.2)

Depth	Description
0'-23'	Fill material/silty clay
23'-38'	Silty sand

LL-GW-04 (Figure 1.2)

Depth	Description
0'-23'	Brown silty clay
23'-32'	Clay, silt and sand
32'-38'	Fine-medium grained sand

4.0 CONCLUSIONS/RECOMMENDATIONS

This report concludes that the Lee's Lane Landfill Site poses a potential threat to ground-water quality of the Ohio Valley alluvial aquifer and to the water quality of the Ohio River on the basis of previous investigations. The seriousness of this potential may be better indicated by the the sample analysis results obtained by this project.

As this project indicates, an attempt to install wells on the landfill will present unnecessary dangers to the field crew. Should future site management needs require the installation of a ground-water monitoring system, the wells should be installed off site. Because the landfill extends down the banks of the Ohio River, the wells should be installed in the Ohio River adjacent to the landfill with the use of a drill rig mounted on a barge. It is likely that these locations would require level B respiratory protection during the drill process; however, the explosive gases encountered on the landfill should not be present in the subsurface below the river. Though adequately constructed wells would prevent the spread of contamination, the risk of inadequate construction always exists. What may appear to be a well of adequate construction may actually be inadequate. By chosing well locations out of the landfill, the possibility of creating an avenue for the spread of contamination is minimized and this problem would be alleviated.

REFERENCES

Harman, Jr., H. D., Gary Clemons, and Jennifer Scott-Simpson, Emergency Action Plan on Lee's Lane Landfill, Ecology and Environment, Inc., TDD No. F4-8012-08, February 16, 1981.

Hazardous Waste Site Investigation, Lee's Lane Landfill, Louisville, Kentucky, April, 1981.